



SCAR Fellowship Report

Effects of natural iron fertilisation by baleen whales on the microbial community in the Southern Ocean



The seaside village of Banyuls-sur-mer where the Laboratoire d'Océanographie Microbienne (LOMIC) is located (view of my office window!).



The LOMIC lab that I joined

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Dates of Activity

24 April 2017 - 22 June 2017

Introduction (~ 100 words)

What motivated the application and project? Brief explanation of the background and rationale for the proposal.

The growth of phytoplankton in large areas of the Southern Ocean is limited by the availability of the trace element iron. Natural sources of iron into the Southern Ocean that fertilise phytoplankton growth include the deposition of atmospheric dust from the surrounding continents, the weathering of shelf sediments, melting of ice (sea ice, icebergs, glaciers etc.) and hydrothermal vents. Little is known on how marine animals recycle iron through their diet. This novel study represented the first attempt to explore how baleen whales can influence the microbial food web through incubation experiments carried out in sub-Antarctic waters.

Project Objectives (~ 100 words)

What were the aims of the project at the outset?

The overall objective was to examine how marine animals influence oceanographic processes in the Southern Ocean and Antarctic regions. This novel study would provide important information on how marine animals interact with the environment they inhabit. Specifically, we set out to examine the ability of whales to influence autotrophic and heterotrophic components of the microbial communities in the Southern Ocean, and the influence of past whaling practices, and future changes as whale populations continue to grow.

Methods, Execution and Results (~200 words)

What was the nature of the research and activities undertaken? Did everything go as you and your host had hoped? What results were generated and how do they reflect expectations?

We conducted an incubation experiment in sub-Antarctic waters around the vicinity of Heard Island in January 2016. The experiment was jointly designed by myself, Andrew Bowie, Ingrid Obernosterer and Stéphane Blain. The incubation experiment was successfully carried out, and the sub-samples for the microbial community analysis was sent to France. During my SCAR Fellowship in France, I learnt to use the Flow Cytometer and FlowJo to measure the pico-nano-eukaryote, heterotrophic bacteria, heterotrophic nanoflagellate and viral abundance in my sub-samples. Preliminary results suggest that the addition of whale faecal material stimulated the heterotrophic community but not the autotrophic community by providing it with a pulse of labile organic carbon.

At present, I am analyzing the iron concentrations in each sub-sample from the incubation experiment. I expect that a combination of iron and organic carbon data that I will measure will shed some light as to why the heterotrophic activity was favored over the autotrophic activity.

Project Outcomes (~ 200 words)

What do you feel were the significant outcomes in terms of the research but also in terms of personal development?

Professionally, I was able to network with researchers abroad, and develop collaborations for my future work. The lab group led by Ingrid and Stéphane consists of a diverse group of postdoctoral and PhD students from China, Spain, Germany, the Netherlands and Austria. In the 2 months that I spent in Banyuls, I was able to discuss aspects of biogeochemistry that was novel to me. My PhD project focused on the chemical availability of iron, and the SCAR fellowship provided me with the opportunity to develop skills in exploring the biological availability of iron, which is a large part of the work conducted by Ingrid and Stéphane. Regular paper reading groups and scientific discussions between the senior researchers, postdocs and PhD students broaden my knowledge on phytoplankton-bacterial interactions.

Personally, the SCAR Fellowship gave me the opportunity to travel and work in a new environment. I had never been to France, and this fellowship has allowed me to grow as a scientist, and as an individual. Over the last few months, I had been in contact with Dr Alessandro Tagliabue on the modelling component of my fellowship. He has now offered me a postdoctoral position at the University of Liverpool commencing 1 February 2018.

Publications, Presentations and Products

Are there papers or articles submitted or in preparation as a result of the Project? Have you made presentations as a result of the Fellowship? Are there significant products as a result that will have use beyond the Fellowship for yourself or others?

I am currently preparing a manuscript based on the results from this experiment. I have recently submitted an abstract entitled 'Iron recycling in the Southern Ocean and its influence on the autotrophic and heterotrophic microbial food web' to the Ocean Sciences meeting, 2018, in Portland, Oregon. I will also be submitting an

abstract for the SCAR conference in Davos, Switzerland to present the results of the SCAR Fellowship.

I hope to be able to use the iron and organic carbon data gathered from this study, and other studies to develop a model looking at the interaction between phytoplankton and heterotrophic bacteria in my new position at the University of Liverpool.

Capacity Building, Education and Outreach Activities (~ 200 words)

As a result of the Fellowship did you engage in educational and/or outreach activities before/during/after your visit? Did you meet with students to explain your work? Did you give a public lecture? Was there any publicity about your visit - either in your host country or your home country?

In France, I presented the preliminary results at an inter-lab meeting held in Banyuls-sur-mer with researchers from Barcelona and Banyuls. In Hobart, I recently presented the preliminary results from this study at the Festival of Bright Ideas in Hobart, Tasmania, which is part of Australia's National Science Week program. In addition to this, I will be presenting this study at the Theo Murphy High Flyers Think Tank amongst other early career researchers (13 – 15 September 2017). I have also been invited to discuss my experience as a SCAR Fellow at the APECS Polar Week (23 September 2017).

Future Plans and Follow ups (~ 100 words)

Do you plan to continue contact with the host institute and others you met as a result of the project? What will be the nature of the future work?

Ingrid Obernosterer and Stéphane Blain will be visiting Hobart in November 2017. During this time, I hope to have a meeting between Ingrid, Stéphane and Andy to finalise the conference presentation and manuscript from this study. I will continue collaborating with Andy, Ingrid and Stéphane during my next position with Alessandro. I also plan to apply for a Marie Curie to continue learning from Ingrid and Stéphane next year (due September 2018).

Personal Impact

How do you feel the Fellowship has and will continue to impact your research and career objectives? What was the main impact for you personally?

The Fellowship has allowed me to broaden my skills and network which will assist me in creating bigger and better collaborations in the future. Although I didn't have the expertise in quantifying microbial community abundance, it was something I was very interested in and the fellowship has given me the opportunity to learn these new skills. I have recently been offered a postdoctoral position in the UK and plan on applying for a Marie Curie next year with the researchers from the host institute. I have also been awarded a berth on an upcoming research voyage in January 2019 where I plan on continuing my collaborations with Andy, Ingrid and Stéphane. The SCAR Fellowship has been instrumental in giving me the stepping stone between my PhD research and a postdoctoral position.

Financial Statement

Please provide a brief breakdown how the funds were used. Example: The SCAR Fellowship was used to help cover travel to the host institute, buy supplies for the experiments and cover a month of rent at the host location.

The SCAR Fellowship was used to cover my flights from Tasmania, Australia to Banyuls-sur-mer, France, accommodation at the research institute, allowance, freight (FedEx to ship samples from Hobart to Banyuls) and analytical costs. I have a remainder of \$USD1,000 of the USD\$10,500 that was awarded, which I will use to cover abstract submission fees for Ocean Sciences meeting and the registration for the SCAR conference.

Acknowledgements and References:

Thank you very much for this award as it has really helped me bridge the gap between what I have done, and what I would like to do in the future. I would like to acknowledge Philippe Catala, Pier van der Merwe, Delphine Lannuzel, Kathrin Wuttig, Tom Holmes and Eva Ortega-Retuerta for their assistance during the experiment and laboratory analysis. Consumables for the experiment was funded through the Holsworth Wildlife Research Endowment and the Antarctic Climate and Ecosystems Cooperative Research Centre Carbon program.